

Gold/Polymer nanogratings fabricated by Nanoimprint Lithography for application as Surface Enhanced Raman Scattering sensors

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Polymers coated with metallic nanoparticles are materials with a large scientific and technological interest. Such a gold-polymer hybrid systems may benefit from the excellent mechanical flexibility, light weight, enhanced durability and low cost of the polymer substrates in comparison with more rigid substrates and from the inherent properties of nanostructured metals. It is known that surface plasmons induced by an electromagnetic field in metallic nanostructures significantly increase the Raman signal leading to a high sensitivity spectroscopic technique referred to as Surface-Enhanced Raman Scattering (SERS) [1] of potential interest for sensing[2]. Here we report on the fabrication of hybrid systems consisting on Nanoimprint Lithographed polymer nanostructures subsequently coated with gold by Pulsed Laser Deposition (PLD). Highly ordered gratings and dots, nanofabricated on polymer films by Nanoimprint Lithography (NIL) can be produced (Fig.1a). Either silicon gratings, prepared by electron beam lithography or anodic aluminum oxide (AAO) membranes were used as stamps to imprint spin-coated polymeric thin films using a thermal nanoimprint system. The capabilities of these nanostructures as substrates for SERS have been investigated using benzenethiol (BT) as a test molecule. As an example, Fig.1b shows the Raman spectrum of a drop of BT diluted to a concentration of 10^{-4} M and dried in air on a gold coated flat polymer film and on a gold coated polymer grating. In the case of BT poured on the spin-coated polymer surface, no Raman signal of BT is observed. However, the spectrum acquired on the gold coated polymer grating clearly displays the BT characteristic bands. The capabilities of these nanostructures for SERS sensing will be discussed.

References

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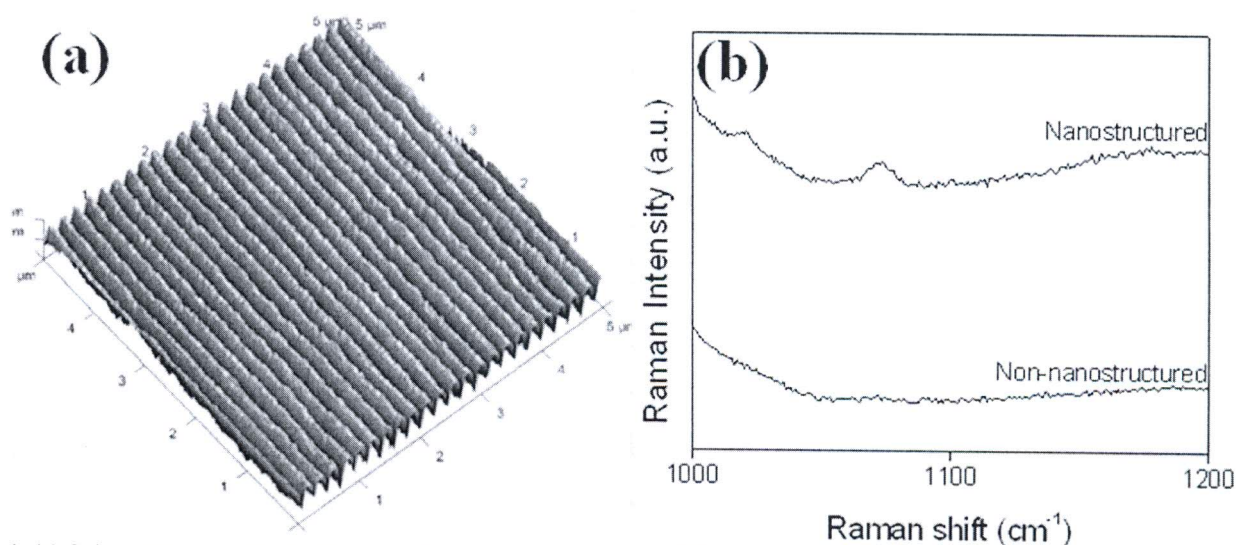


Figure 1: (a) Gold coated polymer grating. (b) Raman spectrum of a drop of BT diluted to a concentration of 10^{-3} M and dried in air on a gold coated polymer film and on a gold coated polymer grating nanofabricated by NIL.